**Unit 2 Part 4 Notes Questions – Enzymes – Key**

**Vocabulary:** Choose four sets of two vocabulary words from your notes. Define each term in the set and identify a connection between the two terms in the set.

1.

Terms: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Definitions and Connection:

2.

Terms: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Definitions and Connection:

1) How are dehydration synthesis and hydrolysis related to catabolism and anabolism?

Dehydration synthesis is a process that puts together smaller molecules to create larger molecules. When smaller molecules are joined, this is called anabolism, which consumes energy. Hydrolysis is a process that breaks down larger molecules into smaller molecules. When larger molecules are broken, this is called catabolism, which releases energy.

2) What is energy coupling? How is ATP typically used in this process?

Energy coupling occurs when the energy released by an exergonic reaction is used to power an endergonic reaction (i.e. one that requires a large input of energy. The breakdown of ATP into ADP and Pi is an exergonic reaction. Energy released by the breakdown of ATP can be used to power an anabolic, endergonic reaction like the creation of a polysaccharide from monosaccharides.

3) How do enzymes speed up the rate of a chemical reaction?

Enzymes speed up the rate of a chemical reaction by lowering the activation energy (aka the energy of activation) for the reaction. The activation energy is the energy required to get the reaction started.

4) Why are the interactions between enzymes and substrates considered “specific?”

Substrates fit into a specific location on the enzyme called the active site. The active site is shaped to accommodate a specific substrate or substrates. If the enzyme takes in a single substrate molecule, it can help to bend the molecule to break bonds and form multiple products. If the enzyme takes in multiple substrate molecules, it can help to bring these molecules close together in the correct position to bond with one another.

5) Why are fevers dangerous for the enzymes in our bodies? (Consider the effect of temperature on enzyme activity.)

Our enzymes function best around normal body temperature (98.6 degrees F). If we have a high fever, the temperature may get so high that the enzyme denatures or loses its shape, and it can no longer perform its function.

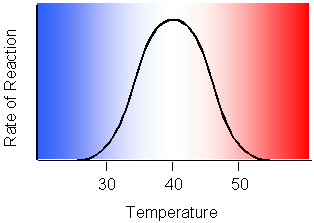
6) Why can’t the rate of reaction increase by adding more substrate molecules at the point of enzyme “saturation?”

Once all the enzyme molecules are saturated, their active sites are all occupied with substrate molecules. At this point, raising the substrate concentration will not increase the rate of reaction because there are no enzyme molecules for them to bind to. As such, the only way to increase the rate of reaction at this point is to add more enzyme molecules to act upon the additional substrate molecules.

7) How are competitive and noncompetitive inhibition different from one another?

In competitive inhibition, the inhibitor molecule binds to the enzyme’s active site and prevents the substrate from entering the active site. In other words, the inhibitor is “competing” with the substrate for access to the enzyme’s active site. If you increase the number of substrate molecules, this increases the chance that the substrate molecules will outcompete the inhibitor molecules and enter the active site.

In noncompetitive inhibition, the inhibitor molecule binds to a different location on the enzyme called the allosteric site. This causes a change in the shape of the enzyme’s active site so that it can no longer fit with its substrate. As such, adding more substrate molecules will not help overcome this type of inhibition because they will not be able to bind to the active site anyway!



8) Which temperature is optimal for the enzyme whose reaction rate is shown in the image to the right?

The enzyme’s optimal temperature is around 40 degrees. I can tell this because the rate of reaction is highest around 40 degrees and then drops significantly at temperatures above or below 40 degrees.

9) Which of the following comparisons or contrasts between endergonic and exergonic reactions is false? (Explain your answer!)

a. Endergonic reactions have a positive ΔG (change in free energy) and exergonic reactions have a negative ΔG

b. Endergonic reactions consume energy and exergonic reactions release energy

This is a TRICK QUESTION. Both of these statements are true!!!

10) Does physical exercise involve anabolic or catabolic processes? (Explain your answer!)

During physical exercise, you are breaking down a lot of ATP to provide the energy for movement. Breaking down a molecule like ATP is a catabolic, exergonic process.

11) Let’s say that a series of enzymatic reactions results in the conversion of glycogen (a polysaccharide stored in the liver) to glucose monomers (used in the bloodstream for energy).

a. If negative feedback occurred in this pathway, how would enzymes in the pathway be affected, and how would the amount of glucose produced be affected?

In negative feedback, the response inhibits/decreases the stimulus. In this example, the product (glucose monomers) represents the response and an enzyme involved early in the process of breaking glucose down represents the stimulus. As such, if this were an example of negative feedback, the glucose monomers would act as inhibitors of the enzyme to prevent the breakdown of more glycogen into glucose.

b. If positive feedback occurred in this pathway, how would enzymes in this pathway be affected, and how would the amount of glucose produced be affected?

In positive feedback, the response activates/increases the stimulus. As such, if this were an example of positive feedback, the glucose monomers would act as activators of the enzyme to better facilitate the breakdown of additional glycogen molecules into glucose.

c. Is it more likely that the breakdown of glycogen is controlled by negative or positive feedback? Why? Relate your answer to homeostasis.

It is more likely that the breakdown of glycogen is controlled by negative feedback. Negative feedback helps us to maintain homeostasis, or stable internal conditions, in our bodies. We must carefully regulate the amount of glucose in our blood and keep its concentration within a narrow range. As such, we would not want to continue breaking down glycogen and releasing extra glucose into the bloodstream unless we needed it right away for energy.